

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 20 JAN 2005

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Applicant's or agent's file reference MM 5160-01WO		FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/JP2004/002019		International filing date (day/month/year) 20.02.2004	Priority date (day/month/year) 24.02.2003	
International Patent Classification (IPC) or national classification and IPC H05K13/08				
Applicant MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 9 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 22.12.2004		Date of completion of this report 21.01.2005		
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**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/JP2004/002019

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-101 as originally filed

Claims, Numbers

1-24 received on 21.12.2004 with letter of 21.12.2004

Drawings, Sheets

1/17-17/17 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/JP2004/002019

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-24
	No: Claims	
Inventive step (IS)	Yes: Claims	1-24
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-24
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1: US-A-5 692 292 (ASAI ET AL.) 2 December 1997 (1997-12-02)

1. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows:
A component mounting apparatus comprising a feed unit with a feed unit control section, a head unit with a head unit control section and a main control section which transmits operation programs to the feed unit and the head unit control section respectively.
The subject-matter of claim 1 differs from this known D1 in that the head unit control section and the feed unit control section can directly communicate with each other.
The subject-matter of claim 1 is therefore new (Article 33(2) PCT).
2. The problem to be solved by the present invention may be regarded as how to improve the coordination of the different units of a component mounting apparatus.
The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reason:
The possibility for direct communication between different units improves the coordination. This is not disclosed nor suggested in closest prior art document D1, where all communication takes place via the main control section.
3. Claims 2-18 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
4. The same reasoning applies to independent claim 19, which discloses the corresponding method, and to dependent claims 20-24.

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Direct Dial: 089/549 075 17

Applicant: MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
Serial Number: PCT/JP2004/002019

AMENDED CLAIMS (clear copy)

1. A component mounting apparatus comprising:
 - a component feed unit (6) for executing component feed operation for feeding a plurality of components (1) in order to allow the components (1) to be picked up;
 - a head unit (4, 404a, 404b) which has a plurality of component holding members (3, 403) for releasably holding the components (1), for executing component holding and pickup operation for holding and picking up the components (1) from the component feed unit (6) to mount the components (1) onto a board (2) by one or the plurality of component holding members (3, 403);
 - a head unit control section (40, 440, 460) for controlling the component holding and pickup operation of the head unit (4, 404a, 404b);

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a component feed unit control section (50, 480) for controlling the component feed operation of the component feed unit (6); and
a main control section (30, 330, 430) for transmitting recipes of an operation programs for executing the operations in the head unit control section (40, 440, 460) and the component feed unit control section (50, 480) to the head unit control section (40, 440, 460) and the component feed unit control section (50, 480), wherein the head unit control section (40, 440, 460) is operable to execute the component holding and pickup operation on basis of the transmitted recipe, and the component feed unit control section (50, 480) is operable to execute the component feed operation based on the transmitted recipe, and
the head unit control section (40, 440, 460) is operable to transmit a timing signal based on the execution of the component holding and pickup operation to the component feed unit control section (50, 480), and the component feed unit control section (50, 480) is operable to complete the component feed operation on the basis of the transmitted recipe and timing signal.

2. The component mounting apparatus as defined in claim 1, wherein the head unit control section (40, 440, 460) is provided for the head unit (4, 404a, 404b), and the component feed unit control section (50, 480) is provided for the component feed unit (6).
3. The component mounting apparatus as defined in claim 1, wherein the component feed unit control section is operable to transmit a timing signal based on the executed component feed operation to the head unit control section, and
the head unit control section is operable to complete the component holding and pickup operation on basis of the transmitted timing signal and recipe.
4. The component mounting apparatus as defined in claim 1, further comprising:
a head moving unit (8, 408a, 408b) for executing head moving operation for moving the head unit (4, 404a, 404b) in a direction roughly parallel to a surface of the board (2); and
a moving unit control section (60, 450, 470) for controlling the head moving operation of the head moving unit (8, 408a, 408b),

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wherein the main control section is operable to transmit the recipe for executing the head moving operation in the moving unit control section (60, 450, 470) to the moving unit control section (60, 450, 470), and the moving unit control section (60, 450, 470) is operable to execute the head moving operation on basis of the transmitted recipe.

/4 5. The component mounting apparatus as defined in claim ~~5~~, wherein the moving unit control section (60, 450, 470) is provided for the head moving unit.

/4 6. The component mounting apparatus as defined in claim ~~5~~, wherein the head unit control section (40, 440, 460) is operable to transmit a timing signal based on the execution of the operation to the moving unit control section (50, 450, 470), and the moving unit control section (60, 450, 470) is operable to complete the head moving operation on basis of the transmitted recipe and timing signal.

16 7. The component mounting apparatus as defined in claim ~~7~~, wherein the moving unit control section (60, 450, 470) is operable to transmit a timing signal based on the executed head moving operation to the head unit control section (40, 440, 460), and the head unit control section (40, 440, 460) is operable to complete the component holding and pickup operation on basis of the transmitted timing signal and recipe.

/4 8. The component mounting apparatus as defined in claim ~~5~~, wherein the head unit (4, 404a, 404b) is operable to execute component mounting operation for mounting the component or components (1) held by the one or the plurality of component holding members by releasing the holding on the board (2), the main control section (30, 330, 430) is operable to transmit the recipe for executing the component mounting operation to the head unit control section (40, 440, 460) and is operable to transmit the recipe for executing the head moving operation for the component mounting operation to the moving unit control section (60, 450, 470), the head unit control section (40, 440, 460) is operable to execute the component mounting operation on basis of the transmitted recipe, and the moving unit

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control section (60, 450, 470) is operable to execute the head moving operation for the component mounting operation on basis of the transmitted recipe.

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9. The component mounting apparatus as defined in claim ~~8~~, wherein the head unit control section (40, 440, 460) is operable to execute the component mounting operation on basis of the transmitted recipe and is operable to transmit a timing signal based on the execution of the operation to the moving unit control section (60, 450, 470), and the moving unit control section (60, 450, 470) is operable to complete the head moving operation for the component mounting operation on basis of the transmitted recipe and timing signal.
10. The component mounting apparatus as defined in claim 1, wherein the recipe for executing for the component holding and pickup operation comprises:
an operation program for executing component holding preparation operation for moving down the one or the plurality of component holding members for holding the component or components (1) in the head unit (4, 404a, 404b) to a component holding standby height position (H1) along a direction roughly perpendicular to a surface of the board; and
an operation program for executing component holding main operation for further moving down the one or the plurality of component holding members from the component holding standby height position and holding the component or components (1) allowing to be picked up in the component feed unit (6) by the one or the plurality of component holding members, and
the head unit control section (40, 440, 460) is operable to make the component feed unit control section (50, 480) recognize completion of the component holding preparation operation on basis of the recipe by transmitting the timing signal.
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11. The component mounting apparatus as defined in claim ~~1~~, wherein the component feed unit (6) comprises a plurality of component pickup positions (7a) in which the components (1) are arranged allowing to be picked up by the component holding member,
the recipe for executing the component feed operation comprises:

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an operation program for executing component feed preparation operation for transporting the components (1) in the component feed unit (6) so that the components (1) are positioned in the component pickup positions (7a); and
an operation program for executing component feed main operation for putting the transported components (1) into a state in which the components (1) can be picked up by the component holding member, and
the component feed unit control section (50, 480) is operable to execute the component feed preparation operation on basis of the recipe, to complete the component feed main operation on basis of the recipe and the timing signal from the head unit control section (40, 440, 460) and to make the head unit control section (40, 440, 460) recognize completion of the component feed main operation by transmitting the timing signal to the head unit control section (40, 440, 460).

- /6
12. The component mounting apparatus as defined in claim 1 or ~~7~~, wherein the head unit control section (40, 440, 460) is operable to transmit a plurality of timing signals formed on basis of elevation positions of each of the component holding members along a direction roughly perpendicular to the surface of the board.
- /4
13. The component mounting apparatus as defined in claim ~~5~~, wherein the main control section (30, 330, 430) comprises:
a recipe forming section (33, 333) for forming each of the recipes; and
a recipe transmission section (32, 332) for transmitting each of the formed recipes.
- /13
14. The component mounting apparatus as defined in claim ~~14~~, wherein the head unit control section (40, 440, 460), the component feed unit control section (50, 480) or the moving unit control section (60, 450, 470) is operable to transmit error information generated when the operations are executed on the basis of the respective recipes to the main control section (30, 330, 430), in the main control section (30, 330, 430), the recipe forming section is operable to correct the recipe relevant to the error information out of the already transmitted recipes on basis of the transmitted error information, and

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the recipe transmission section is operable to transmit the corrected recipe while in order to allow the already transmitted recipe to be replaced by the corrected recipe.

15. The component mounting apparatus as defined in claim 1, wherein the component feed unit (6) comprises a plurality of component pickup positions (7a) that are arranged in a line with a constant pitch (P2) and arranges the components (1) allowing to be picked up by the component holding members, the component holding members are arranged with a constant pitch (P1) of an integral multiple of the constant pitch in the head unit along the direction in which the component pickup positions are arranged, and the recipe for the component feed operation transmitted from the main control section (30, 330, 430) to the component feed unit control section (50, 480) comprises at least positional information of the one or the plurality of component pickup positions (7a) where the component feed operation is executed.
16. The component mounting apparatus as defined in claim ~~16~~, wherein the recipe for the component holding and pickup operation transmitted from the main control section (30, 330, 430) to the head unit control section (40, 440, 460) comprises at least information capable of recognizing the one or the plurality of component holding members in which the component holding and pickup operation is executed and positional information of the one or the plurality of component pickup positions (7a) where the component feed operation is executed.
17. The component mounting apparatus as defined in claim ~~5~~, wherein the recipe for the head moving operation transmitted from the main control section (30, 330, 430) to the moving unit control section (60, 450, 470) comprises at least positional information of a movement position of the one or the plurality of component holding members in a direction roughly along the surface of the board where the component holding and pickup operation is executed or the component mounting operation is executed.
18. The component mounting apparatus as defined in claim ~~18~~, wherein the recipe for the component mounting operation transmitted from the main control section (30, 330, 430) to the head unit control section (40, 440, 460) com-

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prises at least information capable of recognizing the one or the plurality of component holding members by which the component holding and pickup operation is executed or the component mounting operation is executed.

19. A component mounting method for executing component feed operation for feeding a plurality of components (1) in a component feed unit (6) in order to allow the components to be picked up and executing component holding and pickup operation for picking up the components from the component feed unit to mount the components onto a board (2) in a head unit (4, 404a, 404b) that has a plurality of component holding members (3, 403) that releasably hold the components (1) by the one or the plurality of component holding members, the method comprising:

receiving a recipe for the component holding and pickup operation of an operation program for executing the component holding and pickup operation in the head unit (4, 404a, 404b), executing the component holding and pickup operation on basis of the received recipe and transmitting a timing signal based on the execution of the operation to the component feed unit (6); and

receiving a recipe for the component feed operation of an operation program for executing the component feed operation in the component feed unit (6) and completing the component feed operation on basis of the received recipe and the timing signal transmitted from the head unit (4, 404a, 404b).

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20. The component mounting method as defined in claim ~~22~~, wherein each of the recipe for the component holding and pickup operation and the recipe for the component feed operation is formed on a component mounting apparatus main body side provided with the head unit (4, 404a, 404b) and the component feed unit (6), and each of the formed recipes is transmitted from the component mounting apparatus main body side to the head unit (4, 404a, 404b) and the component feed unit (6).

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21. The component mounting method as defined in claim ~~22~~, wherein the timing signal on basis of the execution of the component feed operation based on the recipe is transmitted to the head unit (4, 404a, 404b) during the execution in the component feed unit (6), and

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the component holding and pickup operation is executed in the head unit (4, 404a, 404b) also on basis of the timing signal transmitted from the component feed unit (6).

- /19
22. The component mounting method as defined in claim ~~22~~, further comprising:
executing head moving operation for moving the head unit (4, 404a, 404b) to a place above the board in a head moving unit (8, 408a, 408b) that moves the head unit (4, 404a, 404b) in a direction roughly parallel to a surface of the board (2); and
executing component mounting operation for mounting the component or components (1) held by the one or the plurality of component holding members onto the board (2),
whereby a recipe for the component mounting operation for executing the component mounting operation is received in the head unit (4, 404a, 404b), the component mounting operation is executed on the basis of the received recipe and a timing signal based on the execution is transmitted to the head moving unit (8, 408a, 408b); and
head moving unit (8, 408a, 408b), and the head moving operation is completed on basis a recipe for the head moving operation for executing the head moving operation is received in the of the received recipe and the timing signal transmitted from the head unit (4, 404a, 404b).

- /22
23. The component mounting method as defined in claim ~~25~~, wherein
each of the recipe for the component mounting operation and the recipe for the head moving operation is formed on the component mounting apparatus main body side, and
each of the formed recipes is transmitted from the component mounting apparatus main body side to the head unit (4, 404a, 404b) and the head moving unit (8, 408a, 408b).

- /22
24. The component mounting method as defined in claim ~~25~~, wherein
the timing signal on basis of the execution of the head moving operation based on the recipe is transmitted to the head unit (4, 404a, 404b) during the execution in the head moving unit (8, 408a, 408b), and

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the component mounting operation is executed in the head unit (4, 404a, 404b) also on the basis of the timing signal transmitted from the head moving unit (4, 404a, 404b).